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230. Proposed by G. W. GREENWOOD, M. A. (Oxon), Lebanon, Ill.

Find the value of the determinant of n rows,

$$\begin{vmatrix} 5 & 2 & 0 & 0 & 0 & \dots\dots\dots \\ 2 & 5 & 2 & 0 & 0 & \dots\dots\dots \\ 0 & 2 & 5 & 2 & 0 & \dots\dots\dots \\ 0 & 0 & 2 & 5 & 2 & \dots\dots\dots \\ 0 & 0 & 0 & 2 & 5 & \dots\dots\dots \\ \dots & \dots & \dots & \dots & \dots & \dots\dots\dots \end{vmatrix}$$

[Oxford, 1900.]

Solution by the PROPOSER.

Denote the determinant by u_n . Then $u_n = 5u_{n-1} - 4u_{n-2}$.

Let $S = u_1 + u_2x^2 + u_3x^3 + \dots\dots\dots$ Then

$$(1 - 5x + 4x^2)S = u_1 + (u_2 - 5u_1)x = 5 - 4x.$$

$$S = \frac{5-4x}{1-5x+4x^2} = \frac{1}{3} \left[\frac{16}{1-4x} - \frac{1}{1-x} \right].$$

Then $u_n = 60x^{n-1}$ in $S = \frac{1}{3}[4^{n+1} - 1]$.

Also solved by M. E. Graber.

231. Proposed by O. L. CALLEGOT, Omaha, Neb.

$$\text{Sum to infinity: } \frac{1}{2.3.4} + \frac{1}{5.6.7} + \frac{1}{8.9.10} + \dots\dots\dots$$

Remark by Editor EPSTEEN.

Mr. A. H. Holmes notes that

$$\frac{2}{(2+x)(2+x+1)(2+x+2)} = \frac{1}{2+x} - \frac{2}{2+x+1} + \frac{1}{2+x+2}$$

and then substitutes $x=0, 1, 2, \dots\dots\dots$ From this point on it seems to me that his solution should proceed thus:

$$\frac{1}{1.2.3} + \frac{1}{5.6.7} + \frac{1}{8.9.10} + \dots\dots\dots$$

$$\begin{aligned} &= \frac{1}{2} - \frac{2}{3} + \frac{1}{4} \\ &\quad + \frac{1}{3} - \frac{2}{4} + \frac{1}{5} \\ &\quad \quad + \frac{1}{4} - \frac{2}{5} + \frac{1}{6} \\ &\quad \quad \quad + \frac{1}{5} - \frac{2}{6} + \frac{1}{7} \\ &\quad \quad \quad \vdots \quad \quad \quad \vdots \end{aligned}$$

$$= \frac{1}{2} - \frac{1}{3} = \frac{1}{6}.$$

232. Proposed by F. P. MATZ, Sc. D., Ph. D., Reading, Pa.

If one person out of 50 die annually and one person out of 30 is born annually, how long at this rate would be required for the population to treble itself?

Solution by CHRISTIAN HORNING, A. M., Heidelberg University, Tiffin, Ohio.

Let a be the population at the beginning; then at the end of the first year the population will be $a + (\frac{1}{35} - \frac{1}{50})a = \frac{7}{8}a$; at the end of the second year $\frac{7}{8}a$ of $\frac{7}{8}a = (\frac{7}{8})^2a$; and at the end of the n th year $(\frac{7}{8})^na$.

Hence $(\frac{7}{8})^na = 3a$, whence $n = \frac{\log 3}{\log 76 - \log 75} = 82.94$, or nearly 83 years.

Also solved by J. Scheffer, M. E. Graber, F. R. Honey, R. D. Carmichael, A. H. Holmes, G. W. Greenwood, L. E. Newcomb, and the Proposer.

233. Proposed by J. T. KEYES, Fogg High School, Nashville, Tenn.

At what time between 10 and 11 o'clock is the second hand of a clock one minute space nearer to the hour hand than it is to the minute hand?

I. Solution by J. SCHEFFER, Hagerstown, Md.

Let the time be x minutes past 10 o'clock. We assume that at the beginning of every minute the second hand points at 12 on the dial. The distance of the second hand at the required time is $60x - x = 59x$; and that of the second hand from the hour hand is $60 - 60x - (10 - \frac{1}{2}x) = 50 - 60x + \frac{1}{2}x$.

$\therefore 59x = 50 - 60x + \frac{1}{2}x$, whence $x = \frac{61\frac{1}{2}}{119\frac{1}{2}}$ minutes $= 25\frac{0\frac{45}{7}}{119\frac{1}{2}}$ seconds.

II. Solution by G. W. GREENWOOD, M. A., Professor of Mathematics, McKendree College, Lebanon, Ill.

Let us measure the spaces clockwise from the minute hand to the second hand, and from the second hand to the hour hand. At n minutes and t seconds after ten, the number of minute spaces after the hour at which the hour hand, minute hand, and second hand stand are, respectively,

$$50 + \frac{n}{12} + \frac{t}{720}, \quad n + \frac{t}{60}, \quad t.$$

$$\therefore 50 + \frac{n}{12} + \frac{t}{720} - t + 1 = t - \left(n + \frac{t}{60}\right); \text{ i. e., } 36720 + 780n = 1427t.$$

By putting $n=1, 2, \dots, 59$, we get the corresponding values of t .

Also solved by Frederic R. Honey, A. H. Holmes, and L. E. Newcomb.

GEOMETRY.

257. Proposed by G. I. HOPKINS, A. M., Manchester. N. H.

Construire un triangle équilatéral sachant qu'il doit s'appuyer par ses trois sommets sur trois circonférences concentriques données. *Rouché et Comberousse.*

Solution by J. SCHEFFER, A. M., Hagerstown, Md.

Draw any radius OA of the largest circle, and on this construct the equilateral triangle OAD . From D as center with a radius OE of the middle circle draw an arc cutting the smallest circle at B , so that $DB=OE$, and draw BA , make $AC=AB$, and connect C with B , then ABC be the required triangle.